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ABSTRACT

The fundamental dilemma in adventure programming is eliminating unreasonable risks to participants without also reducing levels of excitement, challenge, and stress. Most accidents are caused by a combination of unsafe conditions, unsafe acts, and error judgments. The best and only way to minimize critical human error in adventure programs is through conscientious planning and action, including rigorous training, intense supervision, constant practice, and systematic maintenance of equipment. Many accidents are sequential in nature and are caused by some simple, overlooked mistake or perception made early on that increased the overall level of risk. A description is given of three phases of injury countermeasures that, even when accidents cannot be prevented, may reduce the frequency and severity of injuries caused by those accidents. Injury countermeasures are listed for ski mountaineering, white-water boating, rock climbing or mountaineering, and rope courses. A list is provided of ideas for improving safety in high adventure programs. (JD)

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MINIMIZING ACCIDENTS AND RISKS IN HIGH ADVENTURE OUTDOOR PURSUITS

by

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MINIMIZING ACCIDENTS AND RISKS IN HIGH ADVENTURE OUTDOOR PURSUITS

Many schools, clubs, leisure service organizations, and other public and private agencies have witnessed recently a dramatic rise in the popularity of various forms of outdoor adventure programs. Activities such as mountaineering, whitewater boating, wilderness camping, and ropes courses, just to mention a few, represent some of the various forms of physical and psychological challenges in nature that have increased in demand. Whether referred to as natural challenge programs, adventure recreation, high adventure outdoor pursuits, or something else, these types of programs are designed to provide challenges in nature by pitting oneself against the environment and in striving to overcome the environment through personal skill.

Taken at face value, many of these activities present great risk of personal injury or loss to participants. In fact, all too frequently the term "risk recreation" is used to describe programs or activities that provide higher than normal exposure to natural and unpredictable danger.

There is no doubt that risks are inherent in the activities just mentioned. In fact, Outward Bound and similar outdoor programs believe that a certain amount of risk is deemed essential and that the hazardous environments in which they operate are necessary to their educational aims. In other words, these programs operate under the philosophy that there is no genuine adventure if there are no real risks.

Although the need for risk may be apparent in adventur. programs, the intent of every sponsoring organization is, or should be, to minimize dangers by providing reasonably safe environments. At the same time, experienced leaders know that accidents cannot always be eliminated regardless of how

careful we plan. Accidents are likely to happen due to the nature of the risks and the nature of the environment in which adventure programs take place. Nonetheless, the fact remains that if adventure programs are to justify their existence, every effort must be made to minimize the potential for injury to participants. Consequently, the fundamental dilemma in adventure programs is how to eliminate unreasonable risks to participants without also reducing levels of excitement, challenge and stress -- those unique and vital elements that represent adventure in the first place. In essence, there seems to be a paradox in attempting to provide both safety and risk in adventure programs. Are there ways to provide great excitement, challenge and adventure in outdoor programs without tipping the scales too heavily to the side of risk? The answer is yes, and the following discussion focuses on methodologies for doing so.

HOW MUCH RISK

Perhaps a starting point is to take a closer look at just how much risk there is in high adventure outdoor pursuits. In this respect, Meyer[1] has made an attempt to gather some useful facts by conducting an informal survey among a number of well established, full-time adventure programs. He estimated a fatality rate of about .5 per million student hours of exposure, as compared to an accident death rate in the U.S. of .1 per million human hours (all causes, at work and away). Thus, he concluded that the risk of fatal accidents in adventure programs may be five times that of everyday activity. On the other hand, these data suggest that adventure programs are safer than a comparable amount of time in an automobile, which he estimated to be about .7 fatalities per million hours exposure.

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1. Meyer, Dan, "The Management of Risk," Journal of Experiential Education, Fall, 1979, pp. 9-14.

We can conclude that there are real and significant risks associated with adventure programs, although they may not be as dangerous as many people might first invision. In fact, the risks in many adventure programs are probably no greater than those present in recreational activities such as softball or basketball. Consequently, it is incorrect to use the term "risk recreation" when referring to all adventure programs. Nonetheless, for some adventure programs, the fact remains that there are objective dangers that must be recognized and, consequently, we must make every effort to minimize the dangers if we are to succeed.

THE NATURE OF ACCIDENTS IN OUTDOOR PURSUITS

With the foregoing in mind, let us now turn our attention to the nature of accidents in high adventure outdoor pursuits -- their causes and contributing factors.

Meyer's analysis of accident reports from various adventure programs led him to conclude that most accidents are caused by a combination of (1) unsafe conditions (which are unobserved or underestimated), (2) unsafe acts (usually on the part of students), and (3) error judgments (usually on the part of the instructor). Following is a more detailed breakdown of the principal causal factors, and their components, which are arranged in order of their frequency of occurrence:

1. Unsafe Conditions: (a) moving water, (b) loose rock, (c) inadequate area security, (d) unexpected weather, (e) improper clothing.
2. Unsafe Acts: (a) poor position, (b) unauthorized procedures, (c) unsafe speed, (d) inadequate water and nutritional intake.

3. Judgement Error: (a) new and unexpected situations, (b) desire to please, (c) misperception, (d) fatigue, (e) distraction.

Many experienced outdoor leaders know that few accidents occur at random but, rather, tend to fall into recognized patterns. In fact, by reviewing those causal factors previously listed, it is obvious that many accidents are initiated and controlled by a pattern of thought -- a considered approach where the situations leading to the accident were not viewed accurately. Therefore, if many accidents are caused, they can be controlled when their causes are identified and understood.

The bottom line is that many accidents happen because people make mistakes. In fact, many accidents are not unforeseeable and therefore we should be able to recognize, prepare for and minimize them. This is especially so for accidents caused by unsafe conditions and unsafe acts, since these causal factors can often be eliminated through the development of policies and operating procedures such as those normally set forth in staff manuals, procedural sessions, or training programs. In other words, we can come up with adequate safety answers before accidents occur. Even so, we can still expect accidents because of judgment error, the limiting human factor that presents the biggest challenge for us to overcome.

Perhaps it should be mentioned that outdoor leaders are not unique when it comes to accidents caused by judgment error, for even highly trained and skilled airline pilots make serious judgment errors in spite of the many checks and balances built into flight safety today. In fact, at least half of the aviation flight accidents are due to a lapse in professional judgment called pilot error. Yet, like the airline industry, perhaps the best and only way to minimize critical human errors in adventure programs is through conscientious planning and action

including rigorous training, intense supervision, constant practice, and systematic maintenance of equipment used in our programs.

Another important aspect of accident dynamics is that many tragic accidents are not due to simple blunders or single events but, rather, are sequential in nature, coming as an end of a chain of events. This might be a series or pattern of subtle, seductive and seemingly inconsequential decisions, or lack of them, that stack up until the entire pattern totters and collapses in disaster (which is usually at a time when we think it wouldn't). According to Helms[2], the sequential accident is the result of miscalculation, and the phenomenon causing the accident was likely some simple, overlooked, mistake or perception early on that increased the overall level of risk.

Interestingly, a report of the American Alpine Club's Safety Committee presented evidence to support the claim that sequential accidents are the most common kind of accidents in adventure/climbing schools.[3] According to a 1979 report, most accidents in these programs occurred as a direct result of an individual trying to please others in the group. It is also of interest to note that the second largest contributing factor to accidents in these schools was trying to adhere to a schedule.

STRATEGIES FOR INJURY PREVENTION

Now that we know something about some of the basic causes of accidents in adventure programs, let us turn our attention to some effective measures used to reduce injuries. Obviously, outdoor program leaders should keep abreast of

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2. Helms, Michael, "Psychological and Sociological Phenomena Affecting the Perceptions of Risk and Hazard in Mountaineering," Process and Concepts in Recreational Sports, pp. 240-253.

3. Ibid., p. 251.

modern theories on safety and the application of strategies or techniques used for injury prevention. A point worth noting is that many safety strategies worth our consideration have been developed by public, government, and private organizations, as well as business and industry. Some of these strategies might easily be adopted or modified for use in any adventure program. For instance, one useful technique is a conceptual model developed by Dr. William Haddon for the U.S. Government's program to curtail traffic accident losses.[4]

Haddon's strategy or concept is aimed at reducing injuries rather than merely preventing accidents. In this respect, even when accidents cannot be prevented, such as those arising from human error, there are ways to reduce the frequency and severity of injuries caused from those accidents. The concept sets forth three steps or phases of injury countermeasures that determine the final outcome of a potential accident or injury. Following is a brief description of the three phases, including examples of how they can be used or applied in outdoor adventure programs.

Three Phases of Injury Countermeasures

Step I. Pre-Event Phase - Preventing potentially injurious events. This phase focuses on the many factors which determine whether or not an accident will take place, such as the elements that cause people and physical or natural forces to move into undesirable interaction.

At the pre-event phase, emphasis is placed on failures that can be prevented by some change in the system, rather than attempting to change errors in human

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4. Clark, Duncan and Brian MacMahon, ed., Preventive and Community Medicine, pp. 109-140; Thygerson, Alton L., Accidents and Disasters, Causes and Countermeasures, pp. 62-71.

action or behavior. For example, applying this phase to a realistic situation in the activity of mountaineering, let's imagine that a lead climber on a vertical face accidently dislodges a rock that falls and cuts a companion's head. In this case, the resulting injury could likely be blamed on the lead climber who dislodged the rock, rather than be attributed either to the injured companion who was not wearing a helmet or to other factors such as climbing in an area known for an inordinate amount of loose or "rotten" rock. Thus, during the pre-event planning phase of the climb, a majority of contributing factors to the accident could have been eliminated. The injury might have been prevented if, among other things, the climbers had been required to wear helmets and/or if a more suitable area for climbing had been selected in the first place.

Step II. Event Phase - Minimizing the changes that injury will result while the activity or event is in progress. This phase requires answering the question, "When an accident takes place, regardless of the cause, what can be done to soften the contact?" This phase follows the idea that accidents will happen, so let's protect humans the best way we can. The corollary of the principle is that neither mechanical failure nor human action shall result in injury.

When possible or practical, preference in this phase should be given to "passive" measures of protection, i.e., those that protect the individual automatically, without action on his or her part. The use of seat belts and air bags in vehicles serves as an example of passive measures of protection in the field of highway safety. Action more directly related to the field of outdoor programming might include using belay ropes and helmets for climbing activities or the use of life vests, wet suits and helmets for whitewater activities.

During the event phase, measures of protection that are less passive than those previously described also must be considered in most forms of outdoor adventure programs. For instance, some normal procedures during a winter outing in the mountains should include a periodic snow stability evaluation to determine the likelihood of avalanches. Likewise, proper route selection and travel techniques would need to be applied. Carrying probe poles and requiring the group to use avalanche cords or electronic transceivers would be yet other advisable procedures that would aid in locating victims buried in an avalanche, should such misfortune take place.

Perhaps the most important injury countermeasure in the event phase, just as in the pre- and post-event phases, is the use of trained and experienced leaders who are capable of providing sufficient supervision as well as instruction that is sequential and graduated in difficulty to match the capabilities of the group. When it comes to handling hazardous activities and possible emergencies, one's knowledge, judgment, maturity, and decision making ability are every bit as important as skill in the activity itself.

Step III. Post-Event Phase - Reducing the necessary consequences of accidents. As mentioned earlier, regardless of how careful we plan, accidents can and do happen. It is for this reason that the post-event phase involves salvaging the situation after an accident has taken place, with the obvious intent of doing so quickly before the consequences of the accident lead to serious injuries or loss.

Salvaging critical incidents requires having the proper back-up systems on hand, such as equipment as well as the knowledge, training, or experience needed to implement the needed action. Depending on the given situation, the proper back-up system needed in an emergency might be specific but appropriate equipment

or supplies such as a well-equipped first aid kit for treating injuries. On the other hand, the proper "system" might require more elaborate undertakings such as, for instance, a search and rescue team attempting to find a lost or injured person in the wilderness. Whatever the situation, the important aspect of the post-event phase is to have the proper equipment on hand as well as the pre-training, practice, knowledge and ability to use it.

Unfortunately, far too many groups involved in adventure programs have not been adequately prepared or trained to deal with real disasters and, consequently, what should have been salvageable situations have far too often resulted in serious injury or loss. Knowledge of what to do in an emergency is one thing, but without practice the end result may be disastrous.

CONCLUSION

With the expanding popularity and interest in outdoor pursuits, sponsoring agencies and program specialists need to become more aware of current strategies and techniques of injury prevention. Although the injury countermeasures presented in this paper appear somewhat simple and straight-forward, nonetheless, they demand a systematized progression in planning and action -- those very things that must be done to make adventure activities as safe as possible. Adventure programs do have their hazards and despite precautions, accidents will occur. Yet, knowing something about the nature of accidents and then using proven strategies for reducing injuries will go a long way towards bringing the risks within acceptable limits.

At the end of this discussion the reader will find a number of injury countermeasures that should be considered in order to reduce the chances of

serious injury or loss of life during participation in designated outdoor activities. These are presented as examples in order to further illustrate the application of the three phases of injury countermeasures previously presented. Also, the reader may wish to review the last section titled, "Ideas for Improving Safety in High Adventure Programs," which lists considerations that can be helpful in reducing the elements of danger and risk in outdoor recreation programs. Considerations are presented for program sponsors, supervisors, administrators and leaders or teachers.

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INJURY COUNTERMEASURES FOR DESIGNATED OUTDOOR ADVENTURE PROGRAMS

TYPE OF PROGRAM	STEP I - PRE-EVENT PHASE	STEP II - EVENT PHASE	STEP III - POST-EVENT PHASE
Ski Mountain-eering	Select/inspect location Determine alternate emergency routes Develop written instructional plan Establish, test, and practice accident procedures Gather data on avalanche meteorology, mountain snowpack, and avalanche phenomena Check on weather forecasts Instigate pre-training and instruction: --travel techniques --map and compass basics --proper clothing/equipment (including shovels, avalanche cord, and probes)	Snow stability evaluation (structure measurement; temp. measurement, etc.) Stabilize slopes if necessary (explosives used, if appropriate) Use avalanche cords or electronic transceivers (skadi system) Route selection and travel techniques: --travel on ridgetops, in dense timber, on rock outcrops, or in valley far from slopes --avoid cornice areas --go straight up or down when ascending or descending slopes	Avalanche victim techniques: --swimming action; --form oxygen pocket for face; --conserve oxygen. Snow avalanche rescue procedures: --probing for victim; --search by electronic transceivers; --use of avalanche dogs Apply proper first aid treatment, including revival, and evacuation techniques Phone numbers/addresses of emergency search and rescue teams Instigate bivouac procedures, if necessary

TYPE OF PROGRAM	STEP I - PRE-EVENT PHASE	STEP II - EVENT PHASE	STEP III - POST-EVENT PHASE
Ski Mountain-eering	--avalanche safety procedures --winter first aid and cold weather emergencies Obtain permits and notify responsible person/agency on planned route and dates	--spend little time on open slopes --only one person cross slope at a time --remove ski pole straps and ski safety straps --loosen other equipment such as pack Carry sectional probes Close supervision and progressive/sequential instruction	
White-water boating	Pre-training and instruction Swimming instruction Select proper equipment (stable watercraft) Written instructional plan Select proper location (class III water)	Proper instruction: --Eskimo roll Life jackets Life lines Buddy system Close supervision Progressive instruction	Water rescue procedures/ systems Resuscitation training Emergency Bivouac procedures SOS and MAYDAY signals

TYPE OF PROGRAM	STEP I - PRE-EVENT PHASE	STEP II - EVENT PHASE	STEP III - POST-EVENT PHASE
White-water boating	Permits and notices or permissions File itinerary Get weather information Accident procedures established/tested Alternate contingency plans established	Briefing on hazards	
Rock climbing or mountain-eering	Select/inspect equipment Select proper location --available campsites free of hazards --stable rock --emergency access routes Pre-training and instruction --knots --belay systems, etc. --climbing signals First aid and emergency procedure training	Rope and hardwear Helmet Harness system Belay techniques Ice axe Close supervision Progressive instruction	Mountain rescue techniques Advanced first aid First aid kit Emergency bivouac procedures SOS and MAYDAY signals Search and rescue phone numbers and addresses

TYPE OF PROGRAM	STEP I - PRE-EVENT PHASE	STEP II - EVENT PHASE	STEP III - POST-EVENT PHASE
Ropes Course	Pre-inspection and maintenance of course	Close supervision Appropriate spotting and belay techniques Teach falling techniques	Advanced first aid First aid kit Emergency phone numbers

IDEAS FOR IMPROVING SAFETY IN HIGH ADVENTURE PROGRAMS

The following considerations can be helpful in reducing the elements of danger and risk in high adventure outdoor pursuits.

Considerations for Sponsors, Supervisors and Administrators

1. Staff selection and training must receive special attention. Look at applicants' leadership experience as well as technical training. Keep in mind that many important qualities are difficult to evaluate, such as good judgment and knowledge, maturity, and one's ability to relate to students. There are no certification programs for such leadership qualities, so look at certification as only partial evidence of competencies.

2. Instigate in-service and pre-course training for your staff, as well as regular evaluations using performance appraisals at the conclusion of each program. Remember that the standard against which program staff should be judged is the action of a reasonable and prudent professional.

3. Do not establish programs or encourage activities that are too dangerous a risk to be practical. Be objective when evaluating such programs and seek advice where necessary to insure safety and freedom from harm for participants. Program personnel must constantly measure the goals and values they expect to derive from the experience against whether they are worth the risk and the cost.

4. Develop a plan of supervision, both general and specific, and use appropriate supervision with sufficient numbers of supervisors/instructors to obtain an adequate ratio. Leader/participant ratios must also be matched to the level of activity as well as the age, maturity, and experience of the students.

5. Use only quality equipment, use it appropriately and, if it is to be worn as a protective device, be sure it is of proper size and fit.

6. Operations and programs should be confined to known areas or locations. Staff should have previous first hand experience in these areas before the program begins.

7. Develop emergency plans, including rescue training, and be committed to readiness.

8. Instigate a program of accident reporting, including "near misses," as well as routine safety inspections and program audits. Use check lists when possible and review all reports and forms regularly, looking for problems, potential causes of accidents or patterns of injuries. Also, study and analyze other accidents in hope of averting your own.

9. Check on insurance programs; accident insurance for the participants and personal liability for the leaders. Also, consider supplementary insurance programs for long trips or specifically hazardous programs. Many professional organizations such as AAHPERD and NRPA offer low cost personal liability policies to their members.

10. Using ideas presented here, as well as others, develop a detailed strategy or a systematic plan of action for injury prevention. Consider using techniques similar to the three phase "Injury Countermeasures" program which includes planning for the pre-event, event, and post-event phases of an activity or program.

Considerations for Leaders and/or Teachers:

1. Leaders are not insurers of safety. On the other hand, they are expected to protect against foreseeable harm by performing as reasonable and prudent professionals. Therefore, there should be "reasonable" preparation for activities involving risk. The higher the risk, the higher the preparation. Your preparation as a professional leader should be much greater than what is required or expected from a group of participants.

2. Stay current in first aid and emergency procedures specific to the activities that you conduct. Likewise, always carry an adequate medical kit. Keep in mind that leaders should know causes and prevention of environmental injuries (frostbite, dehydration, hypothermia, etc.) as well as more common types of injuries. The very minimum medical training for an outdoor leader should include advanced first aid and CPR training, as well as a wilderness first aid course. Additional courses such as emergency medical technician, or CPR instructor training should also be considered.

3. Develop safety rules, policies and procedures for each activity under your responsibility. These can be written in the form of an instructor's handbook, field manual, or area guide (for instance, a guide could show maps, areas of travel, bivouac and evacuation routes, known hazards, weather patterns and trends, sources of water, names and addresses of emergency and medical assistance, and the like).

4. Inspect all equipment for defects before any activity. If a defective piece of equipment could cause injury, don't use it.

5. The ability to avoid accidents might well be related to one's physical and/or emotional health. Therefore, to be reasonably assured that participants are able to withstand the rigors of an adventure program, leaders should know about participants' general level of fitness, overall health status, and previous experience or performance in similar types of programs. Medical exams, experience records, and pre-course conditioning routines can be helpful and possibly should be required from participants. With this type of information, experienced outdoor leaders often can accurately assess those people most likely to avoid accidents and those that are most accident susceptible. For instance, a fatigued, stressed, or depressed person might likely be accident susceptible, as might one who is overly fearful or reluctant to take part in an activity or skill. In general, those who are afraid to try or are afraid of failure need special help.

6. Through pre-trip meetings and/or correspondence, acquaint participants with the dangers and risks of the activity before the activity begins. Remember That release forms or consent forms may not hold up in a court of law, but nonetheless, they can serve as one means of warning people that what they are involved in might be dangerous or could lead to injury. Written forms should cover the objectives and methods used, as well as the risks inherent in the program.

7. Follow desirable safety and instructional practices set forth by recognized organizations and specialists.

8. Use only voluntary participants in activities involving risk. Never require or force anyone to participate.

9. Participation should be in accordance to abilities and readiness for the activity. Do not encourage participants to run the risk of activities which are above their abilities. Screening and ability grouping is important and, in very high risk activities, it would be wise to establish qualifying programs or prerequisites.

   To gage a participant's state of readiness for an activity and to match skill and challenge difficulty, the leader must attempt to analyze the person's performance in order to learn as much as possible about his/her baseline experience, physical condition, and awareness of risks.

10. Ensure that the participants' program of training is sufficient and carefully graduated in difficulty. Likewise, skills should be taught by progression (i.e., in rock climbing, first teach knots, then belaying skills, then climbing techniques).

11. Perform "reasonable" care in activities involving risk. The greater the danger, the greater the care which must be exercised.

12. Always use proper safety procedures and perform inherent duties. Instruct participants as to the activity's proper safety procedures and know and perform the "duties" that are inherent in the activity. (For example, correct belaying is a duty inherent in the activity of rapelling; requiring the use of life vests in an inherent duty in whitewater kayaking). Be sure participants appreciate the risks involved for violating safety rules and practices. Enforce the rules.

13. Don't let your ego get in the way of good leadership. Attempts to please or impress others, to never be proven wrong, or to live up to some real or perceived expectation can lead to problems. Along these same lines, don't give false qualifications or profess competence, expertise and knowledge you do not possess. Likewise, don't guess. When the safety of others depends on the accuracy of information you give out, make sure it is accurate. If you don't know, don't guess.

14. Develop safety consciousness within the group and encourage self reliance. Encourage participants to be fundamentally responsible for their own safety and to rely on their own abilities. Do not create a false sense of security by inviting them to rely on you.

15. Prevent reckless action and keep participants under control. When you are in charge of an activity, do not let another person act or use equipment in a way that may create an "unreasonable" danger to others. Enforce discipline. There is no place for "horseplay" when life may be at stake.

16. You can't be everywhere at once, so organize your group accordingly. Likewise, provide supervision when it "might" prevent injury. Remember that all the risks of outdoor activities cannot be completely eliminated, even with proper care and supervision.

17. Leaders must be cognizant of dangers associated with the risky shift phenomenon, wherein a group tends to make riskier decisions than the individuals in the group would make alone. This is due to the high value our society places on risk taking behavior and results in promoting higher levels of acceptable risk for the group as a whole. Such group decisions can lead to difficult and dangerous situations. Therefore, in high adventure programs, staff must be able to account for participants' abilities to evaluate accurately and deal with both objective and subjective dangers.

18. Maintain a proper attitude towards fear among participants. The fear level should be reasonable.

19. Be aware of "get-homitis." Don't try to adhere to a strict schedule or deadline when it might create problems or a dangerous situation. Always allow leeway in your planning for emergencies.

20. Do your best always. Do any action or activity you undertake to the very best of your ability.

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